

Governance of forest conservation and co-benefits for Bangladesh under changing climate

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Abstract: We focused on key aspects of forest governance for biodiversity conservation in implementing new climate change policies. The national forest institutions must be adaptive to identify the existing pitfalls of prior conservation policies to take advantage of new climate change policies. Strengthening roles and technical capacity of national institutions for systematic biodiversity monitoring and carbon stock assessment is required in developing and least developed countries. Community participation needs careful analysis to ensure equitable access of particular social groups to local decision-making processes and to sustain optional livelihoods. The livelihood options around forest reserves or protected areas must be taken into account to enhance forest-based adaptation.

Keywords: REDD+ (Reducing Emissions from Deforestation and Forest Degradation in Developing Countries), conservation, institution, livelihood, protected areas


Introduction

Forests are one of the biodiversity-rich ecosystems on the earth that provide multiple services for food production, climate regulation, supporting and cultural services (MA 2005). The Strategic

Plan for Biodiversity 2011–2020 of the Convention on Biological Diversity (CBD) and targets of the United Nations (UN) Millennium Development Goals (MDGs) for environmental sustainability are highly linked with sustaining forest biodiversity and meeting societal needs. Forests are facing increasing threats from deforestation, fragmentation of landscapes, invasion of species and climate change-related stress (Thompson et al. 2009). Climate changes are likely to impact forest biodiversity and the carbon storage capacity of forest ecosystems, soil retention and other supporting ecological processes (Woinarski 2010). The protection of forests is not only important for biodiversity, but also for sustaining climate change mitigation and adaptation efforts (O'Connor 2008; Thompson et al. 2009). Forest biodiversity is currently framed within the broader climate change policy framework of the United Nations Framework Convention on Climate Change (UNFCCC) (Werland 2009) for the new policy REDD+ (Reducing Emissions from Deforestation and Forest Degradation in Developing Countries). While REDD+ appears as a new opportunity for improved governance (Thompson et al. 2011), it is important to address whether national institutions can accrue equally the social and ecological benefits under the framework. There are reasons that much of this initiative is grounded within institutional capacity at the national level and particular bio-physical and social contexts.

Bangladesh possesses diverse topography including plain lands, hills and coasts that characterise different forest ecosystems. Bangladesh Forest Department (BFD) estimates total 2.52 million ha of forests cover 17.4% of the surface area of the country (BFD 2012). Major forest areas fall within jurisdiction of BFD and include tree coverage within terrestrial and aquatic habitats. Until the beginning of the 1980s, forest policy has largely followed a top-down approach for revenue generation or production forestry management. This approach largely ignored the impacts of timber harvest on the sustenance of ecological processes needed for long-term preservation of the naturally regenerated forest areas. Afterwards large scale ban on forest harvesting has not significantly contributed to natural forest health due to lack of understanding ecological changes and social linkages in the degraded areas. Plantation only considered

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short-term measures for poverty reduction and to some extent economic viability of forest stands while large-scale threats to sustainability of forests.

The forest cover changes has been estimated at average annual loss of 2,600 ha (0.17%) from 1990 to 2000 in Bangladesh (FAO 2010). Most direct threats to declined forests were lack of regeneration capacity, illicit felling and increased conversion of forest lands into agriculture as source of livelihoods and human settlements for local communities. These factors triggered degradation and deforestation, through the loss of species diversity and fragmentation of forest habitats, and reduced the availability of large-scale goods and services for those engaged in the forestry sector (Mustafa 2002). To ensure community participation for reducing forest dependency as substantial threat to degradation, the social forestry program was initiated through long-term benefit sharing with local people. Since the mid 1980s, this programme has intervened strip plantation and woodlot management system to share the benefits though it was partly collaborative.

Conservation of forest resources were comprehensively incorporated in the national forest policy of 1994 with emphasis for declaration of forest reserve and renewal management of Protected Areas (PAs) (GoB 2011). Despite that policy, the practical shortcoming in forest management was strict control of BFD without community involvement in the conservation programmes until the end of 1990s. Other than social forestry, participation of local communities has been allowed through partial access to specified forest areas for seasonal collection of non-timber forest products (NTFPs). Most recently, Bangladesh is focusing on a co-management approach for integrating social and ecological issues in conservation of PAs. This PA-based conservation program gained momentum due to its collaboration with diverse stakeholders. Nevertheless, PA co-management initiatives have yet to address and integrate the dynamics of ecological change in terms of biodiversity conservation and socio-economics under high levels of climate change impacts.

REDD+ as a new climate policy targets conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries. New climate institutions and associated funding are creating opportunities to strengthen the capability of institutions, organizations and human resources to implement new policies at the local level. Bangladesh is currently preparing a REDD+ readiness programme following UN-REDD guidelines. As REDD+ focuses on protection and sustainable forest management by involving local and indigenous communities, Bangladesh is likely to face institutional challenges in implementing this new program to ensure co-benefits of global mitigation and adaptation for local communities. The prerequisites for REDD+ in Bangladesh are capacity of carbon stock assessment and enhancing biodiversity conservation in diverse forest ecosystems. At the same time, adaptation benefit arrangement for local community and marginalised groups in vulnerable settings is an emerging governance issue in Bangladesh. Here, we discuss challenges that Bangladesh faces in achieving forest conservation while securing socio-economic co-benefits of adaptation to climate change that are relevant to REDD+.

Forest conservation and challenges for potential co-benefits: experiences from Bangladesh

Challenge I: effective conservation responses

Bangladesh government prepared its National Biodiversity Strategies and Action Plans (NBSAP) under the CBD work program (GoB 2004) and recently developed tools and indicators for conservation and sustainable forest management and enhancing carbon stock under REDD+ readiness. The action plan lacks a comprehensive guideline for assessment of plant and animal species with respect to taxonomic classification, size and connectivity of forest stands, and species diversity in PAs. The regeneration capacity following short-mid and long-term disturbances and spatial connectivity for sheltered habitats between core and buffer zones are not equally considered in existing PA management. Tree species richness is one of many possible indicators of overall forest biodiversity, and a more thorough assessment necessarily includes the diversity of fauna and herbaceous vegetation measured across a range of taxa (Persha et al. 2010). Understanding of species responses to changing climate can provide perspectives needed for PA planning and integration with overall conservation strategies.

Conservation within and outside PAs is important for understanding landscape and ecosystem functions in terms of connectivity, resource heterogeneity, stand structure and integrity of systems (Pfund et al. 2008). The challenge of the conservation program is about facilitating the movement of species across the landscape in response to global change, while ensuring the continued viability of individual protected areas, which often represent the last remnants of intact or semi-intact habitat within a region (Hole et al. 2009). PAs are managed isolatedly for conservation purposes within core zones, than any connectivity mechanism with buffer zones. The narrow connectivity level with adjoining landscapes is neither effective management of PA for ecological functions nor maintaining the community roles who are currently appropriating the buffer zone.

Biodiversity conservation strategies are mostly centred around holistic forest approach to avoid population pressure on natural forests. However, this typical approach ignores specific findings of ecological attributes and their underlying causes in threatened forests. There is dearth of important research findings on critical ecological changes in particular forest areas such as hilly watersheds, coastal mangroves that have been until recently documented in Bangladesh. Data limitations or appropriate methodological application affect our capacity to assess and detect the ecological process of PAs (Kharouba and Kerr 2010). Strategies to maintain keystone species in PA system require understanding of how species persist with climate change and colonise new areas within and outside PA boundaries (Hannah et al. 2007). Defining broader conservation goals for maintaining or restoring species in forests or PAs is daunting as it is always challenging in consideration of localities and social conditions and interactions with adjacent landscapes. Enrichment plantation of valuable species within PA core zones or forest opening is only straight-forward solution to increase plant diversity and density

per unit area for Bangladesh. The comparative effectiveness of conservation between self-regeneration and aided restoration should be carefully addressed in the forests that undergo changes with ecological and social perturbations at different temporal scales. Species introduction as only measure stabilize particular properties of the ecosystem though there are multiple interactions among plant and wildlife as well as aquatic attributes associated with the ultimate conservation values. For instance, lack of fresh water flow and inundation level with sedimentation is affecting mangrove ecosystems over the decades in Bangladesh (Nandy and Ahammad 2012). There are substantial evidences required for decision making on conservation measures among different regimes of highly threatened such forests.

PAs have seldom been large enough to maintain critical ecological functions over long periods of time nor have they always been located in valuable habitats with alternative uses (Salafsky and Wollenberg 2000). Comparing PAs with community-managed forest areas, Bolland et al. (2012) argue that neither of these approaches represents the best way to conserve forests. Bangladesh is largely focusing on a PA conservation approach and finding that there is need for further research and development to overcome obstacles to effective conservation. While regulating illegal timber harvest, hunting and extracting non-timber products from protected areas are key challenges to forest conservation, there has been a recent increase in provision of conservation incentives to discourage competitive land uses in favor of eco-sensitive management (Ebeling and Yasue 2009). Conservationists are increasingly achieving success by combining strict protection with incentives in complementary conservation strategies. Multi-level stakeholder understanding, participation and capacity building are important for influencing conservation programs in Bangladesh. The idea is to raise the awareness and consensus of all stakeholders that the protection of forests is essential for improving ecological, social and institutional causes.

Challenge II: on-ground impediments to enhancing carbon stock

Bangladesh forest policy focuses on afforestation and protection of existing natural and semi-natural forests that coincides with the goals of REDD+ for enhancing carbon stock. Bangladesh is likely to secure additional funding sources by extending forest coverage, although this is not as important as conservation goals unless accompanied by understanding site-specific conditions and integration of management responses. For instance, the natural and plantation mangroves have proven to be important resources in Bangladesh for carbon trade under global agreements. Mangroves sequester fifty times more carbon than other tropical forests due to high levels of below-ground biomass, and considerable storage of organic carbon in mangrove sediments (Donato et al. 2011). Accurate annual accounting of existing mangrove coverage, new plantation and degradation by natural and anthropogenic processes is required to ensure future carbon stock areas that can be effectively managed. Protection of mangrove forests is important for improving coastal ecosystem services and providing goods and services for the well-being of local communities. Multiple social benefits of these mangroves

can be enhanced if properly managed and accounted for carbon accounting and accommodating local people. The combined efforts of effective carbon sequestration and conservation should correspond to historical deforestation and current adaptation benefits towards legitimate REDD+ programme (Robinson 2011).

Under the Voluntary Carbon Market (VCM), the Integrated Protected Area Co-management network funded preparation of projects for carbon sequestration in seven PAs of Bangladesh. The projects are currently under review. Supported by GIZ and the Arannayk Foundation, the Management of Natural Resources and Community Forestry (MNRCF-Chunati) project started participatory afforestation, enrichment planting and assisted natural regeneration in 7,764 ha. The project is expected to yield carbon stock enhancement of 760,000 t CO₂ over its duration. The project creates opportunities for revenue generation for the national economy, while bringing additional benefits to local communities. But, the economic feasibility of REDD+ programmes in Bangladesh will depend directly on the values of forest carbon. Adequate knowledge is needed prior to REDD+ implementation in developing countries to determine the price at which selling carbon credits becomes profitable (Pelletier 2012). One important issue for Bangladesh is the determination of the percentage of deforestation that can realistically be reduced. Uncertainties surrounding forest carbon stock arise from quantification errors of emissions from land cover changes, estimation methods, measurement of trees and regional variation in precipitation and temperature changes.

The current institutional capacity in Bangladesh for inventory of carbon stock is not adequate due to lack of current data and application of inappropriate technical methods. This is also the case in many developing countries. Variations in the rate of deforestation might result from inadequate data and uncertainty in analysis of change in forest area. This leads to calculations of emissions that are likely to be spurious (Houghton 2012). Pelletier et al. (2012) raised concern on the risks of underestimation of carbon density that are unlikely to favor developing countries. Satisfying global default values for carbon sequestration requires methodological consistency at the national level and capacity to develop economically justified approaches. Without improved inventory the developing countries cannot achieve specified emission reductions and remain far from achieving successful REDD+. Bangladesh can estimate carbon stock from the current national forest assessment. This, however, is not highly reliable due to the small and partial estimation-based projection of recent years. Small scale sampling without incorporating regional inputs and standard methodological approaches leads to carbon density estimates that are subjective (Chave et al. 2004).

Technical and institutional capacity is needed to develop measuring, reporting and verification frameworks to assess past carbon stock changes, to develop scenarios for current and future rates. More precise measurement of changes in area and changes in forest biomass density will not only contribute role of terrestrial ecosystems in the global carbon budget, but also help monitor and verify international agreements, such as REDD+ in national-level accounting. Assessment of deforestation trends and

calculating tree biomass outside the forest jurisdiction in Bangladesh, in particular private forestry, is undervalued. This indicates that isolated focus on forest credit through carbon stock management is likely to override biodiversity conservation (Kawowski 2011), as there is a functional difference between natural and plantation forest units at broader landscapes. Technical measures such as remote sensing can be useful for assessing deforestation, while ground-based practical measurement is needed for validation of the data on carbon stock (Bond et al. 2009).

Challenge III: sustainability of conservation and co-benefits

Sustainable forest management is emphasized in REDD+ guidelines to secure biodiversity conservation and improve local and national benefits in implementing countries. Bangladesh forest policy also emphasizes a sustainable approach that broadly incorporates protection and enrichment of existing natural and partially degraded forests, afforestation of barren lands to increase forest coverage, and long-term involvement of local communities in forest conservation and development. In practice, forest sustainability was taken into account to balance conservation and deforestation, and to eventually reduce people's dependency and poverty in rural areas. The major shortcoming is, to determine a line of control for increasing conservation and decreasing deforestation.

The REDD+ strategies are unlikely to be satisfactory in Bangladesh due to a lack of understanding of the fundamental causes for deforestation and forest degradation. Annual and periodical basis of forest area changes should be basis of conservation success and navigating the effectiveness and efficiency of collaborative forest regime. The effectiveness of PA conservation in Bangladesh is not adequately supported by data that would enable plotting of a development trajectory before REDD+, although there is community engagement and a positive impact on conservation. Lele et al. (2010) points out basic design flaws that plague most efforts, including poor implementation, assumptions about the homogeneity of communities, and inattention to or inadequate support for tenurial security.

The PA approach already documented several problems in various regions due to: bias in site selection, resource pressure in surrounding areas, varying conservation effectiveness and ethical challenges arising from complete social exclusion. More recently, adopted market-based payments to local communities for protection of forests are increasing options, although tension among the traditional communities regarding property rights and management authority will remain additional challenges in practice. REDD+ facilitate development of markets for and privatization of natural resources that might enable or constrain conservation and development in specific contexts. This can add complexity to community-oriented and rights-based approaches. PA conservation in demarcated core areas might not be sufficient unless surrounding land uses and most deforestation threats in buffer zones are adequately addressed. This is an important reason that deforestation still persists and watershed degradation continues around buffer zones in many countries despite effective governance (Lele et al. 2010; Ahmad et al. 2012).

PA conservation programs inadequately address associated environmental, social and economic changes, and how various drivers influenced past deforestation when documenting the pre-REDD+ baseline (Boutin et al. 2009). The co-management approach in PA conservation of natural forests lacks baseline and target for PA conservation with reference to areas, current and future climatic threats. Accordingly, the capacity for conservation values is not scientifically proved and cannot, therefore, be shared and incorporated in forest management strategies that attempt to address ecological functions and sustainability. Folke et al. (2004) explained that the relationship between biophysical and social factors is multilayered and that any system can undergo changes and exist in multi-equilibrium states. The conservation goal has considerable scope to include single to diverse goals of ecosystem management (Blom et al. 2010). Developing scenarios for forest ecosystems with respect to sustainable framework covering different spatial and temporal scales can help integrate policy to achieve REDD+ goals.

Annual forest demand against deforestation and conservation scenarios in specific forest types is not adequately assessed to develop a comprehensive framework for forest sustainability in Bangladesh. The current collaborative management approach cannot reduce deforestation unless the demand and supply of forest goods and services are quantified and alternative mechanisms for economic benefits of local communities are developed. Local people largely depend on different provisioning services including food, fuel wood, NTFPs etc. from naturally originated mangroves. Household forest areas are commonly developed around rural settlement contributing small wood and fuel energy of families and local markets. The actual contribution of private forest areas are not quantified to understand potential benefit for increasing forest coverage and social benefits.

Local communities are permitted to extract NTFPs under specified time limits in buffer zones of PAs. Short-term livelihood supports and eco-tourism arrangement for alternative income generation are permitted for local communities, though these very rarely generate significant economic benefits at the household level. The use of NTFPs from buffer zones is not based on sustainable harvest, quantity of harvestable products, silvicultural interventions, nor is it monitored for proper management over any time frame for meeting short-, mid- and long-term demand of local communities. Factors including quantity of product to harvest by management unit, harvest cycles by species, and the impacts of harvest on wild populations must be integrated into the resource management strategies of PAs (Secretariat of the Convention on Biological Diversity 2001).

Challenge IV: mainstreaming forest-based adaptation benefits

Mechanisms by which indigenous and local communities are likely to benefit from conservation-led and carbon sequestration programs remain under-addressed in the REDD+ readiness map for Bangladesh. Most of the marginalized groups who need subsistence income from forest products have higher stake with social and environmental changes and the loss of any ecosystem services including forests. Understanding the role of forest eco-

system services for determining adaptation supports is important though not adequately assessed.

The PA-centered conservation initiatives provide impetus for forest governance to integrate co-benefits for local communities within new institutional arrangements. Policy changes for incorporating climate change funds into forest conservation efforts and alternative livelihoods for local communities can yield rapid distribution of benefits. As yet, there is no defined institutional framework for a payment system to the participants for avoiding deforestation and degradation. Compensation is important to all local communities with full understanding of the expected roles and participants, and maintaining the balance between monetary and non-monetary benefits. The benefits should be sufficient to provide clear incentives to land and resource users to change practices (Hoang et al. 2012). The results from Vietnam show that shifting land uses for carbon sequestration and payments provide sustainable funding for forest protection and livelihoods of local communities. Although the short-term benefits of community forestry or agroforestry are relatively high compared to long-term conservation, these are less frequently estimated with land tenure issues.

There is a common weakness in understanding how the rights to forest resources should be distributed and regulated between individuals, communities and the state agencies (Lele et al. 2010). Mainstreaming conservation, sustainable use, poverty alleviation and social equity issues with national planning or particular focus on forestry sector policy is challenging, but these need to be integrated within development policies for supporting adaptation of marginalized people in critically vulnerable areas. For instance, coastal afforestation has long-been recognized as a cost-effective disaster risk reduction program in Bangladesh where community-based mangrove management and benefits to local communities are daunting. Protective and productive use of coastal ecosystems are related to mangrove plantation and stabilising land formation, while restoration of fallow lands and ownership distribution are increasingly becoming important for poverty reduction and adaptation of landless people to climatic risks (Nandy and Ahammad 2012). Direct provision of co-benefits with afforestation for local community and adaptation remain limited. Long-term benefits of mangrove afforestation have not been realized for participatory management and institutional collaboration on sustainable land uses for adaptation in coastal areas.

The REDD+ strategy arrangement is likely to favor the climate change mitigation and biodiversity conservation goals (Kanowski 2011) over adaptation of indigenous and local communities whose livelihoods are at stake in Bangladesh. Effective pro-poor adaptation policy and conservation programmes with equity, empowerment and participation of indigenous and local communities in Bangladesh are important. Government-led forest conservation creates management complexities in rule-making and participation of indigenous dominated forest areas in Bangladesh. Long-time legacy of top-down regulatory process over forest resource use in indigenous areas create complexities and collaboration with local people for forest conservation. This indicates improved outcomes are only likely if REDD+

efforts are accompanied by a substantial effort to reorganize government institutions from highly bureaucratic and arbitrary structures (Larson 2011). Due to the restrictions of indigenous communities on customary land ownership and limited access to government controlled areas, local people are facing increasing competition for rights to resources. Indigenous communities also suffer from imposed decision-making and less capable to defend for securing their rights which are similar problems under new REDD+ readiness. Implementing any forestry program in collaboration with indigenous people for conservation should also focus on improving adaptive capacity. The long-term nature of carbon payments, as opposed to traditional donor financing only for afforestation and conservation, can help local communities for capacity building.

The most compelling issues facing adaptation is developing effective mechanisms for benefit distribution to local communities (Phelps et al. 2010). Bangladesh is gradually shifting into collaborative forest regime though also facing complexities in community involvement for conservation and future carbon sequestration projects. Adequate compensation based on short-, mid- and long-term scale benefits are required in the protection of forest resources. The adaptation options through additional income generation is not based on viable assessment for contribution of forest and other natural resources in REDD+ readiness stage of Bangladesh. To minimize costs and maximize payments, additional ecosystem service benefits can be assessed and added with managing land for carbon payments. Strengthening technical and financial capacity of organization will be vital to calculate opportunity cost of forest regime under collective management and conservation success (Stringer et al. 2012).

Challenge V: inclusive local governance

Inclusion of diverse stakeholders within larger conservation goals and climate change mitigation and adaptation is also challenging in REDD+ (Brown et al. 2008; Thompson et al. 2011). Good governance is necessary to ensure transparency, accountability and equity in delivery of policy, and co-benefits for forest-dependent people from new institutional arrangements. Most emerging complexity is to secure alternative livelihoods within a new conservation approach for social groups who depend entirely on forest products. Community participation in co-management committees sensitized people's attitudes towards protection of local forest resources and inherent values for biodiversity conservation. Yet, it has far reaching economic benefits for local communities (Robinson 2011) as a whole, in particular for landless people who have limited alternative resources in and around PAs and are likely to be vulnerable to any climatic shocks.

Community forestry has increasingly identified conservation benefits and the success of traditional knowledge and ownership building advocates to the effectiveness of the institutions (Ostrom 2003; Agrawal et al 2008, Chhatre and Agrawal 2008; Thoms 2008). Such results were challenged in Bangladesh, as this institutional form also under-addressed imbalance in power relations and the interplay among community members with

external agencies. Thompson et al (2011) argued that REDD+ must be understood within the governance framework for understanding what is governed, who is governed and how is governed for realizing benefit. The underlying social structure associated with different land use patterns, varying access to benefit distribution (Phelps et al. 2010), and recentralization tendency all challenge the forest governance of Bangladesh.

Benefit sharing requires a right-based approach and comprehensive understanding to incorporate climate change risks into current forest resource distribution. Local communities have not developed sense of ownership for forest resources with govt. partnership approach. Creation of management zone for PA, forest reserves and sustainable forest unit are increasing cumulative risks among local communities and indigenous groups on insecure tenure. Berkes (2009) suggests to minimize the trade-offs among the stakeholders in co-management for securing both conservation and development benefits. Existing land ownership conflicts are overriding the collaboration options in indigenous-dominated forest areas of Bangladesh. With decreasing access for forest resource users this can promote deforestation. The rights of communities to share financial benefits and participate in decision-making in REDD+ schemes are pre-requisites, although these do not reflect the inclusion of traditional knowledge in the process or involvement in implementation in many countries (Bond et al. 2009; Lyster 2011). Legitimate right of land tenure has been embedded within broader political system in Bangladesh where clarification of locally adaptive land use policy and ownership that has higher conservation scopes should be given priority from national level.

Limited understanding of local communities on forest protection in climatic changes and weak participation is overriding the effectiveness of conservation measures. Bangladesh has crucial need for the forum of consultation on new norms of forest management for national and local level stakeholders. Recent transfer of decision-making power to local communities under co-management is on testing phase, and so more participation will be needed in the design, implementation, monitoring, verification and evaluation processes of REDD+ process. Social equity is not only part of benefit distribution and also core attention in the time frame of payment because of the diversity of interest groups, their inclusion and exclusion. The shared understanding of different actors in REDD+ projects affect success unless participants able to determine what kind of landscape is desirable, or reach an agreement about multiple forms of land use (Griffiths 2008).

Strengthening co-management structure can add inclusive nature of local institutions and balanced power between govt. and local communities for forest protection and developing new livelihood opportunities. Insignificant involvement of stakeholders and prior consent of local institutions in forest resource governance can fragment social capital (Thompson et al. 2011) and threaten pro-poor equitable benefits of a REDD+ project. Local communities perceive the value of forest conservation is essential, but their institutional access to decision making, relationship on trust and level of resource endowment affect understanding differently (O'Connor 2008). The existing co-management

around PAs for protecting biodiversity in Bangladesh is truly vertical in its collaboration with stakeholders and ignores horizontal linkages and joint learning opportunities. Without horizontal linkage, there is a risk of ignoring the potential stewardship role among forest dwellers who have managed forests for biodiversity conservation using traditional knowledge.

Implementation of climate change policy is grounded within institutional capacity and governance mechanisms whether it fits the bio-physical or social contexts (Young et al. 2008). At the early stage of political democratization in Bangladesh, decentralized decision-making for forest governance is yet to be matured and slowly advancing. The existing co-management approach only provokes further empowerment of local elite groups and strengthens government controlling capacity (Berkes 2009) or recentralizes the management of commons. Important feedback and learning are missing and insufficiently discussed from biological and social consideration around forest management (Phelps et al. 2010). Effectiveness of collaboration will depend on the incentives for social freedom to expand citizen participation and civil society advocacy for reinforcing state responsiveness and accountability (Lyster 2011).

There are weak responses of biodiversity conservation at local and national level in Bangladesh to increasing climate change concerns. Forest along terrestrial and aquatic interface comprise a diversity of natural resources and require a multi-disciplinary approach and coordination of the departments, including forestry, fisheries and agriculture within designated management areas. PA management or adaptation projects led by BFD have limited scopes for comprehensive biodiversity assessment or adaptation options in Bangladesh. The critical institutional collaboration for multiple resource management within the same or close jurisdiction is likely to create mismatch among the govt. agencies and take precedence over ecosystem-based adaptation. There is also to be involved community knowledge for identifying threshold points of NTFPs, monitoring biodiversity in and around PAs or reserves, and selection of species for restoration of degraded forest patches. Conservation policy is not currently developed on technical expertise with interdisciplinary approach to assess and respond to the diversity of ecosystems and associated social, economic and institutional processes.

Conclusions

Governance of forest resources are evolving over time and space in response to the needs of social and biological systems changed either internally or externally (Arts and Buizer 2009; Thompson et al. 2011). Bangladesh exists in the early stage of changing governance from decentralized approaches to community-based conservation and collaborative management. The history of forest management should focus on dynamic social and ecological systems and their relation to climate changes, specifically how related socio-economic and political drivers create fragile ecosystems. Improving forest governance is not a recent concern in Bangladesh that has to deal with transition phase of rebuilding ownership and collective roles.

Co-management approach for forest conservation has recently gained momentum in Bangladesh through focused on PA conservation. The scopes of collaborative forest governance for protecting conserved sites and enhancing livelihoods of adjacent forest-dependent people are large. However, framework of co management approach need to flexible with time frames for conservation and livelihood outcomes. In the case of REDD+ project implementation, conservation goals and the carbon emission targets must be measurable and validated to ensure long-term commitment of ecological sustainability and community payment are well maintained. The deforestation trend in Bangladesh should be assessed through the application of remote sensing technology which can contribute to portray the past forest cover and land use changes and their contribution to carbon sequestration and claiming payment.

Forest conservation is increasingly facing pressure from social and economic factors in sustainable resource use. Shifting efforts for biodiversity conservation from strict reserves to co-management is currently being implemented as pilot initiatives in Bangladesh. An important question is whether co-management approach can protect the rights of local communities and sustain their involvement in conservation efforts that lead to long-term market benefits. Implementing biodiversity conservation programs or new carbon projects in particular social-ecological context has not been easy due to intrinsic complexities in the human-environment nexus, power disparity and political context, and uncertain human demand, all of which affect achievement of goals (Carena and Soltau 2006; Berkes et al. 2009; Blom et al. 2010).

REDD+ arrangement can create a new opportunity for climate change mitigation through increasing afforestation and restoration of forest resources in previously degraded lands. However, achieving the goals of biodiversity conservation and enhanced livelihoods is not congruent to adaptation of local communities. Any payment to communities through alternative livelihood choices can not be said highly satisfactory without understanding social and environmental changes that may arise from income deficiency of local communities and especially marginalised groups without sufficient subsistence supports. Forest governance requires strong performance in terms of legitimacy and effectiveness in initiatives for national and sub-national capacity for transparent assessment of carbon stock and integration of biodiversity conservation and livelihoods. In broad sense, forest conservation and associated mitigation benefits should be recognised with associated and clear indication of adaptation.

Without understanding social-ecological contexts, new institutional arrangements can create trade-offs between multiple resource regimes in Bangladesh and fail to achieve biodiversity conservation at the ecosystem level. There is necessity to review strategic approaches for identifying ecological connectivity, sustainable livelihoods and associated land ownership of forest-dependent indigenous and local people while strengthening formal institutions to improve service transfer. It is urgent to connect existing institutional capacity with scientific interpretation of biodiversity and ecosystem function of forest regimes while examining adaptation to disturbances and climate change.

In addition to capacity building within the Forest Department, it is essential to combine forest conservation with other adaptation programs and create opportunities for additional collaboration with multiple actors in project design, planning and evaluation. Bangladesh is yet to define policies and optimize the effective actions under climate funding for implementation of natural resource based adaptation programs. Building institutional collaboration between BFD and other govt. agencies including NGO and civil societies who have common conservation focus, but differentiated position should be integrated for sustainable resource management and generating adaptation benefits locally. Following new directions under REDD+, national forest policy can identify the priority areas with higher biodiversity values and new PAs and possible ecosystem-based approaches to reconcile livelihood issues in a coherent way. In fact, national forest policy should emphasise climate change-related stress with conservation measures and associated sectors to address the gaps and potential collaborative management.

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